Marked Up Claims. Figure 4 is amended. Also submitted herewith, for approval, is one page of a formal drawing showing Figure 4. No new matter has been added.

Claims 1-52 are now pending in this application. Claims 10-16 are allowed. Claims 3-6, 9, 20, 23, 26, 29, 33, 36, 39, 43, 46, 49, and 52 are objected to as being dependent upon a rejected base claim, but are indicated as allowable if rewritten in independent form including all of the limitation(s) of the base claim and any intervening claims. Applicants wish to thank the Examiner for allowing the claims objected to, if the claims are rewritten in independent form. Claims 1, 2, 7, 8, 17-19, 21, 22, 24, 25, 27, 28, 30-32, 34, 35, 37, 38, 40-42, 44, 45, 47, 48, 50, and 51 are rejected.

In response to the suggestion in the Office Action dated February 21, 2003, Applicants have amended Figure 4 to clarify that element 32 refers to a processor and that element 34 refers to a PWM circuit. Submitted herewith for approval is a Request for Approval of Drawing Change.

Moreover, Applicants have amended Claims 18-52 to re-number the Claims to avoid further mis-communication.

The rejection of Claims 1, 2, 17, 18, 19, 27, 28, 30, 31, and 32 under 35 U.S.C. § 102(b) as being anticipated by Van Landingham is respectfully traversed.

Van Landingham describes motor voltage feedback stabilization for pulse-width-modulated DC servo motor control systems (column 1, lines 5-7). Terminals 34 and 35 of servo motor (10) are connected as input to averaging circuit (58), the output of which represents the average voltage appearing across the servo motor over one or more pulse repetition periods (column 3, lines 38-41). The output of an averaging circuit (58) is connected to potentiometer (60), and potentiometer tap (61) picks off a signal of suitable level for connection to terminal (62) (column 3, lines 47-49). Signal generator (64) develops a zero DC voltage level triangular wave signal as indicated by waveform (66) (column 3,

lines 50-51). This signal is applied to the terminal, and the terminal is connected to summing junction operational amplifier (70) so that the output of the signal generator is a triangular wave having a DC voltage component indicative of the instantaneous motor energization required to reduce the error signal at conductor (50) to zero in a stable manner (column 3, lines 52-57). Resistors (76-79) are of suitable magnitude to obtain the proper gain for the amplifier (column 3, line 58). The output of the amplifier is applied as an input to both comparators (74) and (75) for the purpose of developing pulse-width-modulation energization pulses for transistors (36, 38) (column 3, lines 59-63).

Claim 1 recites a method for controlling speed in a pulse-width-modulation-controlled motor powered by a load voltage source, the method including the steps of "measuring the motor load voltage, and setting pulse-width modulation duty cycles based on the measured voltage, wherein an average of frequencies of the pulse-width modulation duty cycles is a predetermined average pulse-width modulation frequency of the motor".

Van Landingham does not describe or suggest a method as recited in Claim 1. Specifically, Van Landingham does not describe or suggest a method including the steps of setting pulse-width modulation duty cycles based on the measured voltage, wherein an average of frequencies of the pulse-width modulation duty cycles is a predetermined average pulse-width modulation frequency of the motor. Rather, Van Landingham describes that the output of the amplifier is applied as an input to both comparators for the purpose of developing pulse-width-modulation energization pulses for transistors. For the reasons set forth above, Claim 1 is submitted to be patentable over Van Landingham.

Claim 2 depends from independent Claim 1. When the recitations of Claim 2 are considered in combination with the recitations of Claim 1, Applicants submit that dependent Claim 2 likewise is patentable over Van Landingham.

Claim 17 recites a method for operating a motor configured to operate at a variable average speed under pulse-width modulation control, the method including the steps of

"energizing the motor; and setting an average speed by superimposing sweep frequencies onto an average pulse-width modulation frequency, the average pulse-width modulation frequency being a predetermined average of the sweep frequencies".

Van Landingham does not describe or suggest the method as recited in Claim 17. Specifically, Van Landingham does not describe or suggest a method including the step of setting an average speed by superimposing sweep frequencies onto an average pulse-width modulation frequency, the average pulse-width modulation frequency being a predetermined average of the sweep frequencies. Rather, Van Landingham describes that the output of the amplifier is applied as an input to both comparators for the purpose of developing pulse-width-modulation energization pulses for transistors. For the reasons set forth above, Claim 17 is submitted to be patentable over Van Landingham.

Claims 18 and 19 depend from independent Claim 17. When the recitations of Claims 18 and 19 are considered in combination with the recitations of Claim 17, Applicants submit that dependent Claims 18 and 19 likewise are patentable over Van Landingham.

Claim 27 recites a motor including "a housing; a stator mounted in said housing, said stator comprising a stator bore; a rotor rotatably mounted at least partially within said stator bore; and a processor electrically connected to at least one of said stator and said rotor, said processor configured to: determine a load voltage; and set pulse-width modulation duty cycles based on the determined voltage, wherein an average of frequencies of the pulse-width modulation duty cycles is a predetermined average pulse-width modulation frequency of the motor".

Van Landingham does not describe or suggest the motor as recited in Claim 27. Specifically, Van Landingham does not describe or suggest a motor including a processor configured to set pulse-width modulation duty cycles based on the determined voltage, wherein an average of frequencies of the pulse-width modulation duty cycles is a predetermined average pulse-width modulation frequency of the motor. Rather, Van

Landingham describes that the output of the amplifier is applied as an input to both comparators for the purpose of developing pulse-width-modulation energization pulses for transistors. For the reasons set forth above, Claim 27 is submitted to be patentable over Van Landingham.

Claim 28 depends from independent Claim 27. When the recitations of Claim 28 are considered in combination with the recitations of Claim 27, Applicants submit that dependent Claim 28 likewise is patentable over Van Landingham.

Claim 30 recites a motor including "a housing; a stator mounted in said housing, said stator comprising a stator bore; a rotor rotatably mounted at least partially within said stator bore; and a processor electrically connected to at least one of said stator and said rotor, said processor configured to set an average speed by superimposing sweep frequencies onto an average pulse-width modulation frequency, wherein the average pulse-width modulation frequency is a predetermined average of the sweep frequencies".

Van Landingham does not describe or suggest the motor as recited in Claim 30. Specifically, Van Landingham does not describe or suggest a motor including a processor configured to set an average speed by superimposing sweep frequencies onto an average pulse-width modulation frequency, wherein the average pulse-width modulation frequency is a predetermined average of the sweep frequencies. Rather, Van Landingham describes that the output of the amplifier is applied as an input to both comparators for the purpose of developing pulse-width-modulation energization pulses for transistors. For the reasons set forth above, Claim 30 is submitted to be patentable over Van Landingham.

Claims 31 and 32 depend from independent Claim 30. When the recitations of Claims 31 and 32 are considered in combination with the recitations of Claim 30, Applicants submit that dependent Claims 31 and 32 likewise are patentable over Van Landingham.

For the reasons set forth above, Applicants respectfully request that the Section 102 rejection of Claims 1, 2, 17, 18, 19, 27, 28, 30, 31, and 32 be withdrawn.

The rejection of Claims 21, 22, 24, 25, 34, 35, 37, 38, 40-42, 44, 45, 47, 48, 50, and 51 under 35 U.S.C. § 103(a) as being unpatentable over Van Landingham is respectfully traversed.

Van Landingham is described above.

Claims 21, 22, 24, and 25 depend from independent Claim 17, which recites a method for operating a motor configured to operate at a variable average speed under pulse-width modulation control, the method including the steps of "energizing the motor; and setting an average speed by superimposing sweep frequencies onto an average pulse-width modulation frequency, the average pulse-width modulation frequency being a predetermined average of the sweep frequencies".

Van Landingham does not describe or suggest the method as recited in Claim 17. Specifically, Van Landingham does not describe or suggest a method including the step of setting an average speed by superimposing sweep frequencies onto an average pulse-width modulation frequency, the average pulse-width modulation frequency being a predetermined average of the sweep frequencies. Rather, Van Landingham describes that the output of the amplifier is applied as an input to both comparators for the purpose of developing pulse-width-modulation energization pulses for transistors. For the reasons set forth above, Claim 17 is submitted to be patentable over Van Landingham.

When the recitations of Claims 21, 22, 24, and 25 are considered in combination with the recitations of Claim 17, Applicants submit that dependent Claims 21, 22, 24, and 25 likewise are patentable over Van Landingham.

Claims 34, 35, 37, and 38 depend from independent Claim 30 which recites a motor including "a housing; a stator mounted in said housing, said stator comprising a stator bore; a rotor rotatably mounted at least partially within said stator bore; and a processor electrically connected to at least one of said stator and said rotor, said processor configured to set an average speed by superimposing sweep frequencies onto an average pulse-width modulation frequency, wherein the average pulse-width modulation frequency is a predetermined average of the sweep frequencies".

Van Landingham does not describe or suggest the motor as recited in Claim 30. Specifically, Van Landingham does not describe or suggest a motor including a processor configured to set an average speed by superimposing sweep frequencies onto an average pulse-width modulation frequency, wherein the average pulse-width modulation frequency is a predetermined average of the sweep frequencies. Rather, Van Landingham describes that the output of the amplifier is applied as an input to both comparators for the purpose of developing pulse-width-modulation energization pulses for transistors. For the reasons set forth above, Claim 30 is submitted to be patentable over Van Landingham.

When the recitations of Claims 34, 35, 37, and 38 are considered in combination with the recitations of Claim 30, Applicants submit that dependent Claims 34, 35, 37, and 38 likewise are patentable over Van Landingham.

Claim 40 recites a refrigerator including "a housing; a freezer section at least partially within said housing; a fresh food section at least partially within said housing; a motor at least partially within said housing; and a processor electrically connected to said motor, said processor configured to set an average speed of the motor by superimposing sweep frequencies onto an average pulse-width modulation frequency, wherein the average pulse-width modulation frequency is a predetermined average of the sweep frequencies".

Van Landingham does not describe or suggest the refrigerator as recited in Claim 40. Specifically, Van Landingham does not describe or suggest a refrigerator including a

processor configured to set an average speed of the motor by superimposing sweep frequencies onto an average pulse-width modulation frequency, wherein the average pulse-width modulation frequency is a predetermined average of the sweep frequencies. Rather, Van Landingham describes that the output of the amplifier is applied as an input to both comparators for the purpose of developing pulse-width-modulation energization pulses for transistors. For the reasons set forth above, Claim 40 is submitted to be patentable over Van Landingham.

When the recitations of Claims 41, 42, 44, 45, 47, and 48 are considered in combination with the recitations of Claim 40, Applicants submit that dependent Claims 41, 42, 44, 45, 47, and 48 likewise are patentable over Van Landingham.

Claim 50 recites a refrigerator including "a housing; a freezer section at least partially within said housing; a fresh food section at least partially within said housing; a motor at least partially within said housing; and a processor electrically connected to said motor, said processor configured to: determine a load voltage; and set pulse-width modulation duty cycles based on the determined voltage, wherein an average of frequencies of the pulse-width modulation duty cycles is a predetermined average pulse-width modulation frequency of the motor".

Van Landingham does not describe or suggest the refrigerator as recited in Claim 50. Specifically, Van Landingham does not describe or suggest a refrigerator including a processor configured to set pulse-width modulation duty cycles based on the determined voltage, wherein an average of frequencies of the pulse-width modulation duty cycles is a predetermined average pulse-width modulation frequency of the motor. Rather, Van Landingham describes that the output of the amplifier is applied as an input to both comparators for the purpose of developing pulse-width-modulation energization pulses for transistors. For the reasons set forth above, Claim 50 is submitted to be patentable over Van Landingham.

When the recitations of Claim 51 are considered in combination with the recitations of Claim 50, Applicants submit that dependent Claim 51 likewise is patentable over Van Landingham.

Moreover, Applicants respectfully submit that the Section 103 rejection of 21, 22, 24, 25, 34, 35, 37, 38, 44, 45, 47, and 48 is not a proper rejection. The mere assertion that such a method and apparatus would have been obvious to one of ordinary skill in the art does not support a prima facie obvious rejection. Rather, each allegation of what would have been an obvious matter of design choice must always be supported by citation to some reference work recognized as standard in the pertinent art, and Applicants given an opportunity to challenge the correctness of the assertion or the repute of the cited reference. Applicants have not been provided with the citation to any reference supporting the combination made in the rejection. The rejection, therefore, fails to provide the Applicants with a fair opportunity to respond to the rejection, and fails to provide the Applicants with the opportunity to challenge the correctness of the rejection. Therefore, Applicants respectfully request that the Section 103 rejection be withdrawn.

Restriction

For at least the reasons set forth above, Applicants respectfully request that the Section 103 rejection of Claims 21, 22, 24, 25, 34, 35, 37, 38, 40-42, 44, 45, 47, 48, 50, and 51 be withdrawn.

The rejection of Claims 1, 2, 17, 18, 19, 27, 28, 30, 31, and 32 under 35 U.S.C. § 102(b) as being anticipated by Sakoh is respectfully traversed.

Sakoh describes a speed control device for a DC motor. The speed control device includes a power supply voltage (V0) that is applied to a DC motor (M) when a switch element (Q1) is turned on (column 1, lines 24-26). A voltage (Vc) corresponding to a back electromotive force is produced in the DC motor when the switch element is turned off (column 1, lines 26-29). An output voltage (V2) is subtracted from a set voltage (V3) and the subtracted voltage is amplified by an amplifying circuit (4) to obtain a voltage (V4) which

becomes lower as the rotational speed of the DC motor increases and which becomes higher as the rotational speed decreases (column 1, lines 52-57). The amplified voltage V4 is compared with a non-constant voltage (V5) by a comparator circuit (6) (column 1, lines 57-59). As shown in Figure 10(d), the non-constant voltage V5 changes its value at a predetermined frequency which provides a basis of a duty cycle of the switch element (column 1, lines 59-62). The comparator circuit outputs the first level of a control pulse signal V6 to turn on the switch element when the amplified voltage V4, which becomes higher as the rotational speed of the DC motor decreases, exceeds the non-constant voltage V5 (column 1, lines 62-66). As will be apparent from FIG. 10(d), as the rotational speed of the DC motor decreases or the amplified voltage V4 becomes higher, the period during the amplified voltage V4 exceeds the non-constant voltage V5 becomes longer, so that the period during the switch element is kept on becomes longer (column 1, line 66 – column 2, line 4). As a result of this, the duty cycle for driving the DC motor is increased to compensate for the low speed rotation of the DC motor M or to increase the rotational speed of the DC motor (column 2, lines 4-8). On the other hand, if the rotational speed of the DC motor becomes higher, the duty cycle is decreased to reduce the rotational speed of the motor (column 2, lines 8-12).

Claim 1 recites a method for controlling speed in a pulse-width-modulation-controlled motor powered by a load voltage source, the method including the steps of "measuring the motor load voltage, and setting pulse-width modulation duty cycles based on the measured voltage, wherein an average of frequencies of the pulse-width modulation duty cycles is a predetermined average pulse-width modulation frequency of the motor".

Sakoh does not describe or suggest the method as recited in Claim 1. Specifically Sakoh does not describe or suggest a method including the steps of setting pulse-width modulation duty cycles based on the measured voltage, wherein an average of frequencies of the pulse-width modulation duty cycles is an average pulse-width modulation frequency of the motor. Rather, Sakoh describes that the duty cycle for driving the DC motor is increased

to compensate for the low speed rotation of the DC motor M or to increase the rotational speed of the DC motor. For the reasons set forth above, Claim 1 is submitted to be patentable over Sakoh.

Claim 2 depends from independent Claim 1. When the recitations of Claim 2 are considered in combination with the recitations of Claim 1, Applicants submit that dependent Claim 2 likewise is patentable over Sakoh.

Claim 17 recites a method for operating a motor configured to operate at a variable average speed under pulse-width modulation control, the method including the steps of "energizing the motor; and setting an average speed by superimposing sweep frequencies onto an average pulse-width modulation frequency, the average pulse-width modulation frequency being a predetermined average of the sweep frequencies".

Sakoh does not describe or suggest the method as recited in Claim 17. Specifically, Sakoh does not describe or suggest a method including the step of setting an average speed by superimposing sweep frequencies onto an average pulse-width modulation frequency, the average pulse-width modulation frequency being a predetermined average of the sweep frequencies. Rather, Sakoh describes that the duty cycle for driving the DC motor is increased to compensate for the low speed rotation of the DC motor M or to increase the rotational speed of the DC motor. For the reasons set forth above, Claim 17 is submitted to be patentable over Sakoh.

Claims 18 and 19 depend from independent Claim 17. When the recitations of Claims 18 and 19 are considered in combination with the recitations of Claim 17, Applicants submit that dependent Claims 18 and 19 likewise are patentable over Sakoh.

Claim 27 recites a motor including "a housing; a stator mounted in said housing, said stator comprising a stator bore; a rotor rotatably mounted at least partially within said stator bore; and a processor electrically connected to at least one of said stator and said rotor, said

processor configured to: determine a load voltage; and set pulse-width modulation duty cycles based on the determined voltage, wherein an average of frequencies of the pulse-width modulation duty cycles is a predetermined average pulse-width modulation frequency of the motor".

Sakoh does not describe or suggest the motor as recited in Claim 27. Specifically, Sakoh does not describe or suggest a motor including a processor configured to set pulse-width modulation duty cycles based on the determined voltage, wherein an average of frequencies of the pulse-width modulation duty cycles is a predetermined average pulse-width modulation frequency of the motor. Rather, Sakoh describes that the duty cycle for driving the DC motor is increased to compensate for the low speed rotation of the DC motor M or to increase the rotational speed of the DC motor. For the reasons set forth above, Claim 27 is submitted to be patentable over Sakoh.

Claim 28 depends from independent Claim 27. When the recitations of Claim 28 are considered in combination with the recitations of Claim 27, Applicants submit that dependent Claim 28 likewise is patentable over Sakoh.

Claim 30 recites a motor including "a housing; a stator mounted in said housing, said stator comprising a stator bore; a rotor rotatably mounted at least partially within said stator bore; and a processor electrically connected to at least one of said stator and said rotor, said processor configured to set an average speed by superimposing sweep frequencies onto an average pulse-width modulation frequency, wherein the average pulse-width modulation frequency is a predetermined average of the sweep frequencies".

Sakoh does not describe or suggest the motor as recited in Claim 30. Specifically, Sakoh does not describe or suggest a motor including a processor configured to set an average speed by superimposing sweep frequencies onto an average pulse-width modulation frequency, wherein the average pulse-width modulation frequency is a predetermined average of the sweep frequencies. Rather, Sakoh describes that the duty cycle for driving the DC

motor is increased to compensate for the low speed rotation of the DC motor M or to increase the rotational speed of the DC motor. For the reasons set forth above, Claim 30 is submitted to be patentable over Sakoh.

Claims 31 and 32 depend from independent Claim 30. When the recitations of Claims 31 and 32 are considered in combination with the recitations of Claim 30, Applicants submit that dependent Claims 31 and 32 likewise are patentable over Sakoh.

For the reasons set forth above, Applicants respectfully request that the Section 102 rejection of Claims 1, 2, 17, 18, 19, 27, 28, 30, 31, and 32 be withdrawn.

The rejection of Claims 21, 22, 24, 25, 34, 35, 37, 38, 40-42, 44, 45, 47, 48, 50, and 51 under 35 U.S.C. § 103(a) as being unpatentable over Sakoh is respectfully traversed.

Sakoh is described above.

Claims 21, 22, 24, and 25 depend from independent Claim 17 which recites a method for operating a motor configured to operate at a variable average speed under pulse-width modulation control, the method including the steps of "energizing the motor; and setting an average speed by superimposing sweep frequencies onto an average pulse-width modulation frequency, the average pulse-width modulation frequency being a predetermined average of the sweep frequencies".

Sakoh does not describe or suggest the method as recited in Claim 17. Specifically, Sakoh does not describe or suggest a method including the step of setting an average speed by superimposing sweep frequencies onto an average pulse-width modulation frequency, the average pulse-width modulation frequency being a predetermined average of the sweep frequencies. Rather, Sakoh describes that the duty cycle for driving the DC motor is increased to compensate for the low speed rotation of the DC motor M or to increase the

rotational speed of the DC motor. For the reasons set forth above, Claim 17 is submitted to be patentable over Sakoh.

When the recitations of Claims 21, 22, 24, and 25 are considered in combination with the recitations of Claim 17, Applicants submit that dependent Claims 21, 22, 24, and 25 likewise are patentable over Sakoh.

Claims 34, 35, 37, and 38 depend from independent Claim 30 which recites a motor including "a housing; a stator mounted in said housing, said stator comprising a stator bore; a rotor rotatably mounted at least partially within said stator bore; and a processor electrically connected to at least one of said stator and said rotor, said processor configured to set an average speed by superimposing sweep frequencies onto an average pulse-width modulation frequency, wherein the average pulse-width modulation frequency is a predetermined average of the sweep frequencies".

Sakoh does not describe or suggest the motor as recited in Claim 30. Specifically, Sakoh does not describe or suggest a motor including a processor configured to set an average speed by superimposing sweep frequencies onto an average pulse-width modulation frequency, wherein the average pulse-width modulation frequency is a predetermined average of the sweep frequencies. Rather, Sakoh describes that the duty cycle for driving the DC motor is increased to compensate for the low speed rotation of the DC motor M or to increase the rotational speed of the DC motor. For the reasons set forth above, Claim 30 is submitted to be patentable over Sakoh.

When the recitations of Claims 34, 35, 37, and 38 are considered in combination with the recitations of Claim 30, Applicants submit that dependent Claims 34, 35, 37, and 38 likewise are patentable over Sakoh.

Claim 40 recites a refrigerator including "a housing; a freezer section at least partially within said housing; a fresh food section at least partially within said housing; a motor at least

partially within said housing; and a processor electrically connected to said motor, said processor configured to set an average speed of the motor by superimposing sweep frequencies onto an average pulse-width modulation frequency, wherein the average pulse-width modulation frequency is a predetermined average of the sweep frequencies".

Sakoh does not describe or suggest the refrigerator as recited in Claim 40. Specifically, Sakoh does not describe or suggest a refrigerator including a processor configured to set an average speed of the motor by superimposing sweep frequencies onto an average pulse-width modulation frequency, wherein the average pulse-width modulation frequency is a predetermined average of the sweep frequencies. Rather, Sakoh describes that the duty cycle for driving the DC motor is increased to compensate for the low speed rotation of the DC motor M or to increase the rotational speed of the DC motor. For the reasons set forth above, Claim 40 is submitted to be patentable over Sakoh.

When the recitations of Claims 41, 42, 44, 45, 47, and 48 are considered in combination with the recitations of Claim 40, Applicants submit that dependent Claims 41, 42, 44, 45, 47, and 48 likewise are patentable over Sakoh.

Claim 50 recites a refrigerator including "a housing; a freezer section at least partially within said housing; a fresh food section at least partially within said housing; a motor at least partially within said housing; and a processor electrically connected to said motor, said processor configured to: determine a load voltage; and set pulse-width modulation duty cycles based on the determined voltage, wherein an average of frequencies of the pulse-width modulation duty cycles is a predetermined average pulse-width modulation frequency of the motor".

Sakoh does not describe or suggest the refrigerator as recited in Claim 50. Specifically, Sakoh does not describe or suggest a refrigerator including a processor configured to set pulse-width modulation duty cycles based on the determined voltage, wherein an average of frequencies of the pulse-width modulation duty cycles is a

predetermined average pulse-width modulation frequency of the motor. Rather, Sakoh describes that the duty cycle for driving the DC motor is increased to compensate for the low speed rotation of the DC motor M or to increase the rotational speed of the DC motor. For the reasons set forth above, Claim 50 is submitted to be patentable over Sakoh.

When the recitations of Claim 51 are considered in combination with the recitations of Claim 50, Applicants submit that dependent Claim 51 likewise is patentable over Sakoh.

Moreover, Applicants respectfully submit that the Section 103 rejection of Claims 21, 22, 24, 25, 34, 35, 37, 38, 44, 45, 47, and 48 is not a proper rejection. The mere assertion that such a method and apparatus would have been obvious to one of ordinary skill in the art does not support a prima facie obvious rejection. Rather, each allegation of what would have been an obvious matter of design choice must always be supported by citation to some reference work recognized as standard in the pertinent art, and Applicants given an opportunity to challenge the correctness of the assertion or the repute of the cited reference. Applicants have not been provided with the citation to any reference supporting the combination made in the rejection. The rejection, therefore, fails to provide the Applicants with a fair opportunity to respond to the rejection, and fails to provide the Applicants with the opportunity to challenge the correctness of the rejection. Therefore, Applicants respectfully request that the Section 103 rejection be withdrawn.

For at least the reasons set forth above, Applicants respectfully request that the Section 103 rejection of Claims 21, 22, 24, 25, 34, 35, 37, 38, 40-42, 44, 45, 47, 48, 50, and 51 be withdrawn.

The rejection of Claims 27 and 28 under 35 U.S.C. § 102(b) as being anticipated by Mourad et al. is respectfully traversed.

It appears that Mourad et al. is a 35 U.S.C. § 102(e) reference since Mourad et al. was not patented more than one year prior to the filing date, November 14, 2001, of the present

application for patent in the United States. Accordingly, Applicants have treated Mourad et al. as such a reference.

Mourad et al. describe a process for detecting the speed of rotation of a DC electric motor (1) (column 1, lines 6-9). On the basis of a required nominal speed of rotation of the motor, indicated by a signal provided at the input (8a), an electronic unit (8) provides a driver circuit (7) with control signals acting to make the duty cycle of the signal applied to a gate of an electronic switch (5) correspond to this desired speed (column 2, lines 61-65). A voltage (V.sub.0) between a drain of the electronic switch and ground has a qualitative variation illustrated in a left hand part of an upper graph of FIG. 2 (column 2, line 66 – column 3, line 1). The voltage (V.sub.0) has a square wave variation between a maximum value substantially corresponding to a voltage (V.sub.B) delivered from a source (4), and a substantially nil value (column 3, lines 1-6). The electronic unit is set up to detect periodically the effective speed of rotation of the motor by periodically interrupting the application of the PWM control signal to the gate of the electronic switch (column 3, lines 7 – 10). Upon the occurrence of such an interruption, as illustrated by way of an example at instant (t.sub. 1) in FIG. 2, the voltage (V.sub.0) initially has a transient variation with a modest over voltage peak substantially equal to the forward conduction voltage of the recirculation diode 6, followed by a descent to a level which is on average lower than a voltage VB (column 3, lines 10-17). Once this initial transient has decayed, and whilst the application of the control signal to the input of the switch remains interrupted during a time interval between t.sub.2 and t.sub.3 in FIG. 2, the voltage V.sub.0 has an average value equal to the difference between the voltage V.sub.B delivered by the source (4) and an electromotive force (EMF) developed across a winding (2) of the electric motor (column 3, lines 17-23).

Claim 27 recites a motor including "a housing; a stator mounted in said housing, said stator comprising a stator bore; a rotor rotatably mounted at least partially within said stator bore; and a processor electrically connected to at least one of said stator and said rotor, said

processor configured to: determine a load voltage; and set pulse-width modulation duty cycles based on the determined voltage, wherein an average of frequencies of the pulse-width modulation duty cycles is a predetermined average pulse-width modulation frequency of the motor".

Mourad et al. does not describe or suggest the motor as recited in Claim 27. Specifically, Mourad et al. does not describe or suggest a motor including a processor configured to set pulse-width modulation duty cycles based on the determined voltage, wherein an average of frequencies of the pulse-width modulation duty cycles is a predetermined average pulse-width modulation frequency of the motor. Rather, Mourad et al. describe that the voltage V.sub.0 has an average value equal to the difference between the voltage V.sub.B delivered by the source and an electromotive force developed across the winding of the electric motor. For the reasons set forth above, Claim 27 is submitted to be patentable over Mourad et al.

Claim 28 depends from Claim 27. When the recitations of Claim 28 are considered in combination with the recitations of Claim 27, Applicants submit that dependent Claim 28 likewise is patentable over Mourad et al.

For at least the reasons set forth above, Applicants respectfully request that the Section 102 rejection of Claims 27 and 28 be withdrawn.

The rejection of Claims 27 and 28 under 35 U.S.C. § 103(a) as being unpatentable over Mourad et al. is respectfully traversed.

Mourad et al. is described above.

Claim 27 recites a motor including "a housing; a stator mounted in said housing, said stator comprising a stator bore; a rotor rotatably mounted at least partially within said stator bore; and a processor electrically connected to at least one of said stator and said rotor, said

processor configured to: determine a load voltage; and set pulse-width modulation duty cycles based on the determined voltage, wherein an average of frequencies of the pulse-width modulation duty cycles is a predetermined average pulse-width modulation frequency of the motor".

Mourad et al. does not describe or suggest the motor as recited in Claim 27. Specifically, Mourad et al. does not describe or suggest a motor including a processor configured to set pulse-width modulation duty cycles based on the determined voltage, wherein an average of frequencies of the pulse-width modulation duty cycles is a predetermined average pulse-width modulation frequency of the motor. Rather, Mourad et al. describe that the voltage V.sub.0 has an average value equal to the difference between the voltage V.sub.B delivered by the source and an electromotive force developed across the winding of the electric motor. For the reasons set forth above, Claim 27 is submitted to be patentable over Mourad et al.

Claim 28 depends from Claim 27. When the recitations of Claim 28 are considered in combination with the recitations of Claim 27, Applicants submit that dependent Claim 28 likewise is patentable over Mourad et al.

Moreover, Applicants respectfully submit that the Section 103 rejection of Claims 27 and 28 is not a proper rejection. The mere assertion that such a motor would have been obvious to one of ordinary skill in the art does not support a prima facie obvious rejection. Rather, each allegation of what would have been an obvious matter of design choice must always be supported by citation to some reference work recognized as standard in the pertinent art, and Applicants given an opportunity to challenge the correctness of the assertion or the repute of the cited reference. Applicants have not been provided with the citation to any reference supporting the combination made in the rejection. The rejection, therefore, fails to provide the Applicants with a fair opportunity to respond to the rejection, and fails to provide the Applicants with the opportunity to challenge the correctness of the

rejection. Therefore, Applicants respectfully request that the Section 103 rejection be withdrawn.

For at least the reasons set forth above, Applicants respectfully request that the Section 103 rejection of Claims 27 and 28 be withdrawn.

The rejection of Claims 1, 2, 27, and 28 under 35 U.S.C. § 102(e) as being anticipated by Kobuzaka et al. is respectfully traversed.

Kobuzaka et al. describe a stepping motor controller. The stepping motor controller includes an excitation signal generator which receives input pulse signals and generates excitation signals for controlling excitation sequence for a winding of the stepping motor, a switching circuit that receives the excitation signals and controls the excitation sequence for the winding of the stepping motor by a plurality of switching devices, a PWM constant current control circuit for controlling current flowing through the switching circuit to be a predetermined current set value, and a current sensor for detecting current flowing through the winding (column 2, lines 44-57). The stepping motor controller further includes a motor detector portion that includes a motor detector circuit that transmits a control signal for generating a constant current for a predetermined time for detecting the motor, a constant current generator that receives the control signal and generates the constant current to be supplied to the winding, a reference voltage generator that generates a reference voltage, a voltage comparator circuit that compares the reference voltage with a voltage drop at the winding, and a current value setting signal generator circuit that transforms an output of the voltage comparator circuit into a current value setting signal for the PWM constant current control circuit (column 2, line 60-column 3, line 6). An output of the current value setting signal generator circuit is connected to a current value setting terminal of the PWM constant current control circuit (column 2, lines 7-10).

Claim 1 recites a method for controlling speed in a pulse-width-modulation-controlled motor powered by a load voltage source, the method including the steps of "measuring the

motor load voltage, and setting pulse-width modulation duty cycles based on the measured voltage, wherein an average of frequencies of the pulse-width modulation duty cycles is a predetermined average pulse-width modulation frequency of the motor".

Kobuzaka et al. does not describe or suggest the method as recited in Claim 1. Specifically, Kobuzaka et al. does not describe or suggest a method including the steps of setting pulse-width modulation duty cycles based on the measured voltage, wherein an average of frequencies of the pulse-width modulation duty cycles is an average pulse-width modulation frequency of the motor. Rather, Kobuzaka et al. describe the current value setting signal generator circuit that transforms an output of the voltage comparator circuit into a current value setting signal for the PWM constant current control circuit. For the reasons set forth above, Claim 1 is submitted to be patentable over Kobuzaka et al.

Claim 2 depends from independent Claim 1. When the recitations of Claim 2 are considered in combination with the recitations of Claim 1, Applicants submit that dependent Claim 2 likewise is patentable over Kobuzaka et al.

Claim 27 recites a motor including "a housing; a stator mounted in said housing, said stator comprising a stator bore; a rotor rotatably mounted at least partially within said stator bore; and a processor electrically connected to at least one of said stator and said rotor, said processor configured to: determine a load voltage; and set pulse-width modulation duty cycles based on the determined voltage, wherein an average of frequencies of the pulse-width modulation duty cycles is a predetermined average pulse-width modulation frequency of the motor".

Kobuzaka et al. does not describe or suggest the motor as recited in Claim 27. Specifically, Kobuzaka et al. does not describe or suggest a motor including a processor configured to set pulse-width modulation duty cycles based on the determined voltage, wherein an average of frequencies of the pulse-width modulation duty cycles is a predetermined average pulse-width modulation frequency of the motor. Rather, Kobuzaka

et al. describe the current value setting signal generator circuit that transforms an output of the voltage comparator circuit into a current value setting signal for the PWM constant current control circuit. For the reasons set forth above, Claim 27 is submitted to be patentable over Kobuzaka et al.

Claim 28 depends from independent Claim 27. When the recitations of Claim 28 are considered in combination with the recitations of Claim 27, Applicants submit that dependent Claim 28 likewise is patentable over Kobuzaka et al.

For at least the reasons set forth above, Applicants respectfully request that the Section 102 rejection of Claims 1, 2, 27 and 28 be withdrawn.

The rejection of Claim 7 under 35 U.S.C. § 102(b) as being anticipated by Lambropoulos et al. is respectfully traversed.

Lambropoulos et al. describe a control circuit for operating a power switch having opened and closed conditions and adapted to direct a high magnitude driving current from a power supply through an electric circuit when the power switch is in its closed condition (column 3, lines 39-44). This control circuit includes testing means for directing a low magnitude-testing current through a load circuit while the power switch itself is in the opened condition, sensing means for creating a control signal indicative of a predetermined electrical characteristic, i.e. high current in the load circuit, shifting means for shifting the power switch into its closed condition when the control signal has a predetermined value, i.e. when the current is below a reference level, and protecting means for interrupting the high magnitude driving current through the load circuit when the driving current exceeds a predetermined value (column 3, lines 44-56). This latter protecting means is in the control circuit and opens the power relay whenever high current is experienced by the motor in operation (column 3, lines 56-59). Before operation of the load, such as a motor, by closing the power switch, a low magnitude testing current is supplied through the motor circuit for a short testing cycle, in the preferred embodiment, 3.0 seconds (column 3, lines 59-62).

Claim 7 recites a method for controlling speed in a pulse-width-modulation-controlled motor powered by a load voltage, the load voltage supplied by a supply voltage, the method including the steps of "diagnosing motor functionality using a difference between the supply voltage and the load voltage; switching from motor functionality diagnosis to motor speed control; and setting an average speed of the motor by superimposing sweep frequencies onto an average pulse-width frequency, the average pulse-width frequency being a predetermined average of the sweep frequencies".

Lambropoulos et al. does not describe or suggest a method as recited in Claim 7. Specifically, Lambropoulos et al. does not describe or suggest a method including the step of setting an average speed of the motor by superimposing sweep frequencies onto an average pulse-width frequency, the average pulse-width frequency being a predetermined average of the sweep frequencies. Rather, Lambropoulos et al. describe a control circuit for operating a power switch having opened and closed conditions and adapted to direct a high magnitude driving current from a power supply through an electric circuit when the power switch is in its closed condition. For the reasons set forth above, Claim 7 is submitted to be patentable over Lambropoulos et al.

The rejection of Claim 8 under 35 U.S.C. § 103(a) as being unpatentable over Lambropoulos et al. is respectfully traversed.

Lambropoulos et al. is described above.

Claim 8 depends from Claim 7 which recites a method for controlling speed in a pulse-width-modulation-controlled motor powered by a load voltage, the load voltage supplied by a supply voltage, the method including the steps of "diagnosing motor functionality using a difference between the supply voltage and the load voltage; switching from motor functionality diagnosis to motor speed control; and setting an average speed of the motor by superimposing sweep frequencies onto an average pulse-width frequency, the average pulse-width frequency being a predetermined average of the sweep frequencies"..

Lambropoulos et al. does not describe or suggest the method as recited in Claim 7. Specifically, Lambropoulos et al. does not describe or suggest a method including the step of setting an average speed of the motor by superimposing sweep frequencies onto an average pulse-width frequency, the average pulse-width frequency being a predetermined average of the sweep frequencies. Rather, Lambropoulos et al. describe a control circuit for operating a power switch having opened and closed conditions and adapted to direct a high magnitude driving current from a power supply through an electric circuit when the power switch is in its closed condition. For the reasons set forth above, Claim 7 is submitted to be patentable over Lambropoulos et al.

When the recitations of Claim 8 are considered in combination with the recitations of Claim 7, Applicants submit that dependent Claim 8 likewise is patentable over Lambropoulos et al.

Moreover, Applicants respectfully submit that the Section 103 rejection of Claim 8 is not a proper rejection. The mere assertion that such a method would have been obvious to one of ordinary skill in the art does not support a prima facie obvious rejection. Rather, each allegation of what would have been an obvious matter of design choice must always be supported by citation to some reference work recognized as standard in the pertinent art, and Applicants given an opportunity to challenge the correctness of the assertion or the repute of the cited reference. Applicants have not been provided with the citation to any reference supporting the combination made in the rejection. The rejection, therefore, fails to provide the Applicants with a fair opportunity to respond to the rejection, and fails to provide the Applicants with the opportunity to challenge the correctness of the rejection. Therefore, Applicants respectfully request that the Section 103 rejection be withdrawn.

For at least the reasons set forth above, Applicants respectfully request that the Section 103 rejection of Claim 8 be withdrawn.

In view of the foregoing amendments and remarks, all the claims now active in this application are believed to be in condition for allowance. Reconsideration and favorable action is respectfully solicited.

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9D-HR-19209
PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Gray et al.	Art Unit: 2837
Serial No.: 09/993,783	Examiner: Bentsu Ro
Filed: November 14, 2001	
For: DC MOTOR SPEED CONTROL SYSTEM	

SUBMISSION OF MARKED UP CLAIMS

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Submitted herewith are marked up claims in accordance with 37 C.F.R. Section 1.211(c)(1)(ii), wherein additions are underlined and deletions are [bracketed].

IN THE CLAIMS

1. (once amended) A method for controlling speed in a pulse-width-modulation-controlled motor powered by a load voltage source, said method comprising the steps of:

measuring the motor load voltage; and

setting [a pulse-width-modulation duty cycle]pulse-width modulation duty cycles based on the measured voltage, wherein an average of frequencies of the pulse-width modulation duty cycles is a predetermined average pulse-width modulation frequency of the motor.

7. (once amended) A method for controlling speed in a pulse-width-modulation-controlled motor powered by a load voltage, the load voltage supplied by a supply voltage, said method comprising the steps of:

diagnosing motor functionality using a difference between the supply voltage and the load voltage; [and]

switching from motor functionality diagnosis to motor speed control; and

setting an average speed of the motor by superimposing sweep frequencies onto an average pulse-width frequency, the average pulse-width frequency being a predetermined average of the sweep frequencies.

17. (once amended) A method for operating a motor configured to operate at a variable average speed under pulse-width modulation control, said method comprising the steps of:

energizing the motor; and

setting an average speed by superimposing [a sweep frequency]sweep frequencies onto an average pulse-width modulation frequency, the average pulse-width modulation frequency being a predetermined average of the sweep frequencies.

[19]18. (once amended) A method in accordance with Claim [18]17 wherein said step of setting an average speed further comprises the step of setting an average speed by superimposing a sweep frequency range onto an average pulse-width modulation frequency forming a monotonically increasing waveform.

[20]19. (once amended) A method in accordance with Claim [18]17 wherein said step of setting an average speed further comprises the step of setting an average speed by superimposing a sweep frequency range onto an average pulse-width modulation frequency forming a monotonically decreasing waveform.

[21]20. (once amended) A method in accordance with Claim [18]17 wherein said step of setting an average speed further comprises the step of setting an average speed by superimposing a sweep frequency range onto an average pulse-width modulation frequency forming a random waveform centered around the average pulse-width modulation frequency.

[22]<u>21</u>. (once amended) A method in accordance with Claim [18]<u>17</u> wherein said step of setting an average speed further comprises the step of setting an average speed by superimposing a sweep frequency range onto an average pulse-width modulation frequency forming a monotonically increasing waveform with a low value approximately 20% below the average and a high value approximately 20% above the average.

[23]<u>22</u>. (once amended) A method in accordance with Claim [18]<u>17</u> wherein said step of setting an average speed further comprises the step of setting an average speed by superimposing a sweep frequency range onto an average pulse-width modulation frequency forming a monotonically decreasing waveform with a low value approximately 20% below the average and a high value approximately 20% above the average.

[24]<u>23</u>. (once amended) A method in accordance with Claim [18]<u>17</u> wherein said step of setting an average speed further comprises the step of setting an average speed by superimposing a sweep frequency range onto an average pulse-width modulation frequency forming a random waveform centered around the average pulse-width modulation frequency with a low value approximately 20% below the average and a high value approximately 20% above the average.

[25]<u>24</u>. (once amended) A method in accordance with Claim [18]<u>17</u> wherein said step of setting an average speed further comprises the step of setting an average speed by superimposing a sweep frequency range onto an average pulse-width modulation frequency forming a monotonically increasing waveform with a low value at least approximately 5% below the average and a high value at least approximately 5% above the average.

[26]<u>25</u>. (once amended) A method in accordance with Claim [18]<u>17</u> wherein said step of setting an average speed further comprises the step of setting an average speed by superimposing a sweep frequency range onto an average pulse-width modulation frequency forming a monotonically decreasing waveform with a low value at least approximately 5% below the average and a high value at least approximately 5% above the average.

[27]26. (once amended) A method in accordance with Claim [18]17 wherein said step of setting an average speed further comprises the step of setting an average speed by superimposing a sweep frequency range onto an average pulse-width modulation frequency forming a random waveform centered around the average pulse-width modulation frequency with a low value at least approximately 5% below the average and a high value at least approximately 5% above the average.

[28]27. (once amended) A motor comprising:

a housing;

a stator mounted in said housing, said stator comprising a stator bore;

a rotor rotatably mounted at least partially within said stator bore; and

a processor electrically connected to at least one of said stator and said rotor, said processor configured to:

determine a load voltage; and

set [a pulse width modulation duty cycle]pulse-width modulation duty cycles based on the determined voltage, wherein an average of frequencies of the pulse-width modulation duty cycles is a predetermined average pulse-width modulation frequency of the motor.

[29]28. (once amended) A motor in accordance with Claim [28]27 wherein said processor further configured to diagnose motor functionality.

[30]29. (once amended) A motor in accordance with Claim [29]28 wherein said processor further configured to diagnose motor functionality by calculating power use in accordance with:

$$\frac{[(Upper\_A/D\_\mathrm{Re}ading)-(Lower\_A/D\_\mathrm{Re}ading)]^2}{Rsense}$$

where $Upper\_A/D\_Reading$ is a supply voltage measurement, $Lower\_A/D\_Reading$ is a load voltage measurement, and $Rsense$ is a resistance between measurement locations for $Upper\_A/D\_Reading$ and $Lower\_A/D\_Reading$.

[31]<u>30</u>. (once amended) A motor comprising:

a housing;

a stator mounted in said housing, said stator comprising a stator bore;

a rotor rotatably mounted at least partially within said stator bore; and

a processor electrically connected to at least one of said stator and said rotor, said processor configured to set an average speed by superimposing [a sweep frequency]<u>sweep frequencies</u> onto an average pulse-width modulation frequency<u>, wherein the average pulse-width modulation frequency is a predetermined average of the sweep frequencies</u>.

[32]<u>31</u>. (once amended) A motor in accordance with Claim [31]<u>30</u> wherein said processor further configured to set an average speed by superimposing a sweep frequency range onto an average pulse-width modulation frequency forming a monotonically increasing waveform.

[33]<u>32</u>. (once amended) A motor in accordance with Claim [31]<u>30</u> wherein said processor further configured to set an average speed by superimposing a sweep frequency range onto an average pulse-width modulation frequency forming a monotonically decreasing waveform.

[34]<u>33</u>. (once amended) A motor in accordance with Claim [31]<u>30</u> wherein said processor further configured to set an average speed by superimposing a sweep frequency range

onto an average pulse-width modulation frequency forming a random waveform centered around the average pulse-width modulation frequency.

[35]34. (once amended) A motor in accordance with Claim [31]30 wherein said processor further configured to set an average speed by superimposing a sweep frequency range onto an average pulse-width modulation frequency forming a monotonically increasing waveform with a low value approximately 20% below the average and a high value approximately 20% above the average.

[36]35. (once amended) A motor in accordance with Claim [31]30 wherein said processor further configured to set an average speed by superimposing a sweep frequency range onto an average pulse-width modulation frequency forming a monotonically decreasing waveform with a low value approximately 20% below the average and a high value approximately 20% above the average.

[37]36. (once amended) A motor in accordance with Claim [31]30 wherein said processor further configured to set an average speed by superimposing a sweep frequency range onto an average pulse-width modulation frequency forming a random waveform centered around the average pulse-width modulation frequency with a low value approximately 20% below the average and a high value approximately 20% above the average.

[38]37. (once amended) A motor in accordance with Claim [31]30 wherein said processor further configured to set an average speed by superimposing a sweep frequency range onto an average pulse-width modulation frequency forming a monotonically increasing waveform with a low value at least approximately 5% below the average and a high value at least approximately 5% above the average.

[39]38. (once amended) A motor in accordance with Claim [31]30 wherein said processor further configured to set an average speed by superimposing a sweep frequency range onto an average pulse-width modulation frequency forming a monotonically decreasing

waveform with a low value at least approximately 5% below the average and a high value at least approximately 5% above the average.

[40]39. (once amended) A motor in accordance with Claim [31]30 wherein said processor further configured to set an average speed by superimposing a sweep frequency range onto an average pulse-width modulation frequency forming a random waveform centered around the average pulse-width modulation frequency with a low value at least approximately 5% below the average and a high value at least approximately 5% above the average.

[41]40. (once amended) A refrigerator comprising:

a housing;

a freezer section at least partially within said housing;

a fresh food section at least partially within said housing;

a motor at least partially within said housing; and

a processor electrically connected to said motor, said processor configured to set an average speed of the motor by superimposing [a sweep frequency]sweep frequencies onto an average pulse-width modulation frequency, wherein the average pulse-width modulation frequency is a predetermined average of the sweep frequencies.

[42]41. (once amended) A refrigerator in accordance with Claim [41]40 wherein said processor further configured to set an average speed by superimposing a sweep frequency range onto an average pulse-width modulation frequency forming a monotonically increasing waveform.

[43]42. (once amended) A refrigerator in accordance with Claim [41]40 wherein said processor further configured to set an average speed by superimposing a sweep frequency

range onto an average pulse-width modulation frequency forming a monotonically decreasing waveform.

[44]43. (once amended) A refrigerator in accordance with Claim [41]40 wherein said processor further configured to set an average speed by superimposing a sweep frequency range onto an average pulse-width modulation frequency forming a random waveform centered around the average pulse-width modulation frequency.

[45]44. (once amended) A refrigerator in accordance with Claim [41]40 wherein said processor further configured to set an average speed by superimposing a sweep frequency range onto an average pulse-width modulation frequency forming a monotonically increasing waveform with a low value approximately 20% below the average and a high value approximately 20% above the average.

[46]45. (once amended) A refrigerator in accordance with Claim [41]40 wherein said processor further configured to set an average speed by superimposing a sweep frequency range onto an average pulse-width modulation frequency forming a monotonically decreasing waveform with a low value approximately 20% below the average and a high value approximately 20% above the average.

[47]46. (once amended) A refrigerator in accordance with Claim [41]40 wherein said processor further configured to set an average speed by superimposing a sweep frequency range onto an average pulse-width modulation frequency forming a random waveform centered around the average pulse-width modulation frequency with a low value approximately 20% below the average and a high value approximately 20% above the average.

[48]47. (once amended) A refrigerator in accordance with Claim [41]40 wherein said processor further configured to set an average speed by superimposing a sweep frequency range onto an average pulse-width modulation frequency forming a monotonically increasing

waveform with a low value at least approximately 5% below the average and a high value at least approximately 5% above the average.

[49]<u>48</u>. (once amended) A refrigerator in accordance with Claim [41]<u>40</u> wherein said processor further configured to set an average speed by superimposing a sweep frequency range onto an average pulse-width modulation frequency forming a monotonically decreasing waveform with a low value at least approximately 5% below the average and a high value at least approximately 5% above the average.

[50]<u>49</u>. (once amended) A refrigerator in accordance with Claim [41]<u>40</u> wherein said processor further configured to set an average speed by superimposing a sweep frequency range onto an average pulse-width modulation frequency forming a random waveform centered around the average pulse-width modulation frequency with a low value at least approximately 5% below the average and a high value at least approximately 5% above the average.

[51]<u>50</u>. (once amended) A refrigerator comprising:

a housing;

a freezer section at least partially within said housing;

a fresh food section at least partially within said housing;

a motor at least partially within said housing; and

a processor electrically connected to said motor, said processor configured to:

determine a load voltage; and

set [a pulse width modulation duty cycle]<u>pulse-width modulation duty cycles</u> based on the determined voltage, <u>wherein an average of frequencies of the pulse-width</u>

modulation duty cycles is a predetermined average of pulse-width modulation frequency of the motor.

[52]51. (once amended) A refrigerator in accordance with Claim [51]50 wherein said processor further configured to diagnose motor functionality.

[53]52. (once amended) A motor in accordance with Claim [52]51 wherein said processor further configured to diagnose motor functionality by calculating power use in accordance with:

$$\frac{[(Upper\_A/D\_\mathrm{Re}ading) - (Lower\_A/D\_\mathrm{Re}ading)]^2}{Rsense}$$

where $Upper\_A/D\_Reading$ is a supply voltage measurement, $Lower\_A/D\_Reading$ is a load voltage measurement, and $Rsense$ is a resistance between measurement locations for $Upper\_A/D\_Reading$ and $Lower\_A/D\_Reading$.

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